Search History

STN
HCAPLUS, INSPEC, USPATFULL, JAPIO)
5/3/05

=> d l9 1-23 abs,bib

L9 ANSWER 1 OF 23 USPATFULL on STN
AB In an annealing process in which laser light is irradiated to a semiconductor thin film, a refractive index of the semiconductor thin film after laser light irradiation is measured and conditions for the next laser light irradiation are adjusted based on the measured refractive index value. For example, laser light irradiation conditions are adjusted so that semiconductor thin films always have the same refractive index. As a result, the annealing can be performed under the same conditions at every laser light irradiation even if the laser light irradiation conditions vary unavoidably.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2004:247350 USPATFULL
TI Optical processing **apparatus** and optical processing method
IN Yamaguchi, Naoaki, Yokohama-shi, JAPAN
Tanaka, Koichiro, Atsugi-shi, JAPAN
Teramoto, Satoshi, Atsugi-shi, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Atsugi-shi, JAPAN (non-U.S. corporation)
PI US 2004191945 A1 20040930
AI US 2004-816899 A1 20040405 (10)
RLI Division of Ser. No. US 2002-35441, filed on 4 Jan 2002, GRANTED, Pat. No. US 6716283 Division of Ser. No. US 2000-547716, filed on 11 Apr 2000, GRANTED, Pat. No. US 6336969 Division of Ser. No. US 1995-451648, filed on 26 May 1995, GRANTED, Pat. No. US 6059873
PRAI JP 1994-139404 19940530
DT Utility
FS APPLICATION
LREP ERIC ROBINSON, PMB 955, 21010 SOUTHBANK ST., POTOMAC FALLS, VA, 20165
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 8 Drawing Page(s)
LN.CNT 735
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 2 OF 23 USPATFULL on STN
AB When the CW laser oscillator is employed in the manufacturing process of the semiconductor **device**, it is expected to obtain the **device** of high performance. However, the CW oscillator provides only a small beam spot and forms an inferior crystalline region when it is scanned on the semiconductor film. It is necessary to minimize such an inferior crystalline region because it gives a problem in terms of high integration of the semiconductor element. In view of the problem, the present invention is to form a long crystalline region as suppressing the formation of the inferior crystalline region by irradiating the fundamental wave with the harmonic supplementarily (refer to FIG. 1). The present invention also includes a constitution in which a part having high energy density in the fundamental wave is irradiated to a part having low energy density in the harmonic

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2004:221467 USPATFULL
TI Laser irradiation method, laser irradiation **apparatus**, and method for manufacturing semiconductor **device**
IN Tanaka, Koichiro, Atsugi-shi, JAPAN
Yamazaki, Sunpei, Setagaya, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Atsugi-shi, JAPAN (non-U.S. corporation)
PI US 2004171237 A1 20040902
AI US 2004-787120 A1 20040227 (10)
PRAI JP 2003-54695 20030228
DT Utility
FS APPLICATION
LREP ERIC ROBINSON, PMB 955, 21010 SOUTHBANK ST., POTOMAC FALLS, VA, 20165
CLMN Number of Claims: 17

ECL Exemplary Claim: 1
DRWN 19 Drawing Page(s)
LN.CNT 1946
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 3 OF 23 USPATFULL on STN
AB A linear laser light which has an energy and is to be scanned is irradiated to a semiconductor **device** formed on a substrate, and then the substrate is rotated to irradiate to the semiconductor **device** a linear laser light which has a higher energy than that of the irradiated linear laser light and is to be scanned. Also, in a semiconductor **device** having an analog circuit region and a remaining circuit region wherein the analog circuit region is smaller than the remaining circuit region, a linear laser light having an irradiation area is irradiated to the analog circuit region without moving the irradiation area so as not to overlap the laser lights by scanning. On the other hand, the linear laser light to be scanned is irradiated to the remaining circuit region.

AN 2004:97342 USPATFULL
TI Method for laser-processing semiconductor **device**
IN Zhang, Hongyong, Kanagawa, JAPAN
Yamaguchi, Naoaki, Kanagawa, JAPAN
Takemura, Yasuhiko, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., JAPAN (non-U.S. corporation)
PI US 6723590 B1 20040420
AI US 2000-615842 20000713 (9)
RLI Division of Ser. No. US 1999-236620, filed on 26 Jan 1999, now patented, Pat. No. US 6509212 Division of Ser. No. US 1996-641695, filed on 2 May 1996, now patented, Pat. No. US 6096581 Continuation of Ser. No. US 1995-400867, filed on 8 Mar 1995, now abandoned
PRAI JP 1994-66592 19940309
JP 1994-124172 19940513
DT Utility
FS GRANTED
EXNAM Primary Examiner: Niebling, John F.; Assistant Examiner: Simkovic, Viktor
LREP Nixon Peabody LLP, Costellia, Jeffrey L.
CLMN Number of Claims: 70
ECL Exemplary Claim: 1
DRWN 43 Drawing Figure(s); 9 Drawing Page(s)
LN.CNT 1031

L9 ANSWER 4 OF 23 USPATFULL on STN
AB A method of **crystallizing** an **amorphous silicon** layer includes the steps of generating an **excimer laser** beam having a **first energy density** and a **second energy density**, irradiating an amorphous silicon layer with at least one exposure of the excimer, wherein the **first energy density** melts the amorphous silicon layer to a first depth from a surface of the amorphous silicon layer equal to the **first** thickness and the **second energy density** melts the amorphous silicon layer to a second depth from the surface of the amorphous silicon layer less than the first thickness.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2004:80069 USPATFULL
TI **Excimer laser crystallization** of **amorphous silicon** film
IN Chung, Se-Jin, Gyeongsangbuk-do, KOREA, REPUBLIC OF
PA LG. PHILIPS CO., LTD. (non-U.S. corporation)
PI US 2004060506 A1 20040401
AI US 2003-689030 A1 20031021 (10)
RLI Division of Ser. No. US 2001-965844, filed on 1 Oct 2001, GRANTED, Pat. No. US 6656270
PRAI KR 2000-57832 20001002
DT Utility

FS APPLICATION
LREP MORGAN LEWIS & BOCKIUS LLP, 1111 PENNSYLVANIA AVENUE NW, WASHINGTON, DC, 20004
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 6 Drawing Page(s)
LN.CNT 468
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 5 OF 23 USPATFULL on STN
AB To provide a continuous-oscillating laser **apparatus** capable of improving the efficiency of substrate treatment, a method of irradiating a laser beam, and a method of manufacturing a semiconductor **device** using the laser **apparatus**. Of the entire semiconductor film, a portion that needs to be left on the substrate after patterning is identified according to a mask. Then, a portion to be scanned by respective lasers are defined, so that a laser beam is irradiated twice in different scanning directions to a portion to be obtained at least through patterning and beam spots are impinged upon the scanned portion, thereby partially crystallizing the semiconductor film. In other words, in the invention, it is arranged in such a manner that a laser beam is not irradiated by scanning a laser beam across the entire semiconductor film but by scanning a laser beam twice at least to the absolutely necessary portion. According to the above arrangement, it is possible to save the time to irradiate a laser beam in waste to the semiconductor film at a portion to be removed through patterning, and the crystalline characteristics of the semiconductor film obtained after the patterning can be further enhanced.

AN 2003:213954 USPATFULL
TI Laser **apparatus**, laser irradiating method, manufacturing method of semiconductor **device**, semiconductor **device** , manufacturing **system** of semiconductor **device** using the laser **apparatus**, and electronic **device**
IN Yamazaki, Shunpei, Tokyo, JAPAN
Ohtani, Hisashi, Kanagawa, JAPAN
Hiroki, Masaaki, Kanagawa, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Shiga, Aiko, Kanagawa, JAPAN
Shimomura, Akihisa, Kanagawa, JAPAN
Akiba, Mai, Kanagawa, JAPAN
PA SEMICONDUCTOR ENERGY LABORATORY CO., LTD., Atsugi-shi, JAPAN (non-U.S. corporation)
PI US 2003148594 A1 20030807
AI US 2002-289219 A1 20021107 (10)
PRAI JP 2001-344208 20011109
DT Utility
FS APPLICATION
LREP NIXON PEABODY, LLP, 8180 GREENSBORO DRIVE, SUITE 800, MCLEAN, VA, 22102
CLMN Number of Claims: 26
ECL Exemplary Claim: 1
DRWN 38 Drawing Page(s)
LN.CNT 3015

L9 ANSWER 6 OF 23 USPATFULL on STN
AB It is an object of the invention to provide a technique forming a crystalline semiconductor film whose orientation is uniform by control of crystal orientation and obtaining a crystalline semiconductor film in which concentration of an impurity is reduced. A configuration of the invention is that a first semiconductor region is formed on a substrate having transparent characteristics of a visible light region, a barrier film is formed over the first semiconductor region, a heat retaining film covering a top and side surfaces of the first semiconductor region is formed through the barrier film, the first semiconductor region is crystallized by scanning of a continuous wave laser beam from one edge of the first semiconductor region to the other through the substrate, the heat retaining film and the barrier film are removed, then a second semiconductor region is formed as an active layer of TFT by etching the

first semiconductor region. A pattern of the second semiconductor region formed by etching is formed in a manner that a scanning direction of the laser beam and a channel length direction of the TFT are arranged in almost the same direction in order to smooth drift of carriers.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2003:86384 USPATFULL
TI Method for manufacturing semiconductor **device**
IN Yamazaki, Shunpei, Tokyo, JAPAN
PI US 2003059990 A1 20030327
AI US 2002-224628 A1 20020821 (10)
PRAI JP 2001-262356 20010830
DT Utility
FS APPLICATION
LREP NIXON PEABODY, LLP, 8180 GREENSBORO DRIVE, SUITE 800, MCLEAN, VA, 22102
CLMN Number of Claims: 34
ECL Exemplary Claim: 1
DRWN 24 Drawing Page(s)
LN.CNT 1692
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 7 OF 23 USPATFULL on STN
AB In an annealing process in which laser light is irradiated to a semiconductor thin film, a refractive index of the semiconductor thin film after laser light irradiation is measured and conditions for the next laser light irradiation are adjusted based on the measured refractive index value. For example, laser light irradiation conditions are adjusted so that semiconductor thin films always have the same refractive index. As a result, the annealing can be performed under the same conditions at every laser light irradiation even if the laser light irradiation conditions vary unavoidably.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:117928 USPATFULL
TI Optical processing **apparatus** and optical processing method
IN Yamaguchi, Naoaki, Yokohama-shi, JAPAN
Tanaka, Koichiro, Atgsugi-shi, JAPAN
Teramoto, Satoshi, Atsugi-shi, JAPAN
PI US 2002059896 A1 20020523
US 6716283 B2 20040406
AI US 2002-35441 A1 20020104 (10)
RLI Division of Ser. No. US 2000-547716, filed on 11 Apr 2000, PATENTED
Division of Ser. No. US 1995-451648, filed on 26 May 1995, PATENTED
PRAI JP 1994-139404 19940530
DT Utility
FS APPLICATION
LREP NIXON PEABODY, LLP, 8180 GREENSBORO DRIVE, SUITE 800, MCLEAN, VA, 22102
CLMN Number of Claims: 21
ECL Exemplary Claim: 1
DRWN 8 Drawing Page(s)
LN.CNT 724
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 8 OF 23 USPATFULL on STN
AB One of objects of the present invention is to provide a method of carrying out a laser annealing with sufficient uniformity and high productivity in a wide thickness range of a non-single crystal semiconductor film. According to one aspect of the present invention, a laser irradiation **apparatus** for carrying out irradiation while scanning a linear laser beam in a beam width direction is characterized in that the laser beam on an irradiation surface has a **first energy density** in a **first** beam width and a **second energy density** in a **second** beam width, and the **second energy density** is higher than the **first energy density**.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:117020 USPATFULL

TI Laser irradiation **apparatus**, laser irradiation method, beam homogenizer, semiconductor **device**, and method of manufacturing the semiconductor **device**
IN Tanaka, Koichiro, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, JAPAN (non-U.S. corporation)
PI US 6392810 B1 20020521
AI US 1999-409908 19991001 (9)
PRAI JP 1998-299141 19981005
JP 1998-283751 19981006
DT Utility
FS GRANTED
EXNAM Primary Examiner: Ben, Loha
LREP Robinson, Eric J., Nixon Peabody LLP
CLMN Number of Claims: 66
ECL Exemplary Claim: 1
DRWN 33 Drawing Figure(s); 13 Drawing Page(s)
LN.CNT 1377
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 9 OF 23 USPATFULL on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy density profile that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to satisfy a relationship L.sub.n≥D.

AN 2002:85247 USPATFULL
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Kusumoto, Naoto, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd, a Japanese corporation (non-U.S. corporation)
PI US 2002045288 A1 20020418
US 6558991 B2 20030506
AI US 2001-930758 A1 20010815 (9)
RLI Continuation of Ser. No. US 1998-141763, filed on 27 Aug 1998, PENDING
Division of Ser. No. US 1997-800026, filed on 12 Feb 1997, PATENTED
PRAI JP 1996-50888 19960213
DT Utility
FS APPLICATION
LREP SCOTT C. HARRIS, Fish & Richardson P.C., Suite 500, 4350 La Jolla Village Drive, San Diego, CA, 92122
CLMN Number of Claims: 37
ECL Exemplary Claim: 1
DRWN 16 Drawing Page(s)
LN.CNT 992

L9 ANSWER 10 OF 23 USPATFULL on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy density profile that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to satisfy a relationship L.sub.n≥D.

AN 2002:82439 USPATFULL
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Kusumoto, Naoto, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, JAPAN (non-U.S.

corporation)
PI US 6373870 B1 20020416
AI US 1998-141763 19980827 (9)
RLI Division of Ser. No. US 1997-800026, filed on 12 Feb 1997, now patented, Pat. No. US 5815494
PRAI JP 1996-50888 19960213
DT Utility
FS GRANTED
EXNAM Primary Examiner: Scott, Jr., Leon
LREP Fish & Richardson P.C.
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 32 Drawing Figure(s); 16 Drawing Page(s)
LN.CNT 937

L9 ANSWER 11 OF 23 USPATFULL on STN
AB A method of **crystallizing** an **amorphous** **silicon** layer includes the steps of generating an **excimer laser** beam having a **first** **energy density** and a **second energy** **density**, irradiating an amorphous silicon layer with at least one exposure of the excimer, wherein the **first energy** **density** melts the amorphous silicon layer to a first depth from a surface of the amorphous silicon layer equal to the **first** thickness and the **second energy density** melts the amorphous silicon layer to a second depth from the surface of the amorphous silicon layer less than the first thickness.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:71490 USPATFULL
TI **Excimer laser crystallization** of **amorphous silicon** film
IN Chung, Se-Jin, Gyeongsangbuk-do, KOREA, REPUBLIC OF
PA LG.PHILIPS LCD CO., LTD. (non-U.S. corporation)
PI US 2002038626 A1 20020404
US 6656270 B2 20031202
AI US 2001-965844 A1 20011001 (9)
PRAI KR 2000-57832 20001002
DT Utility
FS APPLICATION
LREP MORGAN LEWIS & BOCKIUS LLP, 1111 PENNSYLVANIA AVENUE NW, WASHINGTON, DC, 20004
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 6 Drawing Page(s)
LN.CNT 468
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 12 OF 23 USPATFULL on STN
AB In an annealing process in which laser light is irradiated to a semiconductor thin film, a refractive index of the semiconductor thin film after laser light irradiation is measured and conditions for the next laser light irradiation are adjusted based on the measured refractive index value. For example, laser light irradiation conditions are adjusted so that semiconductor thin films always have the same refractive index. As a result, the annealing can be performed under the same conditions at every laser light irradiation even if the laser light irradiation conditions vary unavoidably.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:5661 USPATFULL
TI Optical processing **apparatus** and optical processing method
IN Yamaguchi, Naoaki, Kanagawa, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Teramoto, Satoshi, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, JAPAN (non-U.S. corporation)
PI US 6336969 B1 20020108

AI US 2000-547716 20000411 (9)
RLI Continuation of Ser. No. US 1995-451648, filed on 26 May 1995, now patented, Pat. No. US 6059873
PRAI JP 1994-139404 19940530
DT Utility
FS GRANTED
EXNAM Primary Examiner: Alanko, Anita
LREP Robinson, Eric J., Nixon Peabody LLP
CLMN Number of Claims: 38
ECL Exemplary Claim: 1
DRWN 14 Drawing Figure(s); 8 Drawing Page(s)
LN.CNT 808
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 13 OF 23 USPATFULL on STN
AB A laser crystallization method comprises the steps of providing a film of semiconductor material on an insulating substrate, and scanning a pulsed laser beam over the film, the laser beam being shaped to define a chevron. Each pulse of the laser beam comprises at least a first pulse portion of a first energy and a second subsequent pulse portion of a second energy. The first and second pulse portions of each pulse are applied at substantially the same position over the film. This method is used to form electronic devices and enables reliable crystallization to form large single crystal areas in thin semiconductor films.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2001:1702 USPATFULL
TI Laser crystallization of thin films
IN McCulloch, David J., Redhill, United Kingdom
PA U.S. Philips Corporation, New York, NY, United States (U.S. corporation)
PI US 6169014 B1 20010102
AI US 1999-379060 19990823 (9)
PRAI GB 1998-19338 19980904
DT Utility
FS Granted
EXNAM Primary Examiner: Smith, Matthew; Assistant Examiner: Lee, Jr., Granvill D.
LREP Fox, John C.
CLMN Number of Claims: 9
ECL Exemplary Claim: 1
DRWN 3 Drawing Figure(s); 2 Drawing Page(s)
LN.CNT 269
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 14 OF 23 USPATFULL on STN
AB A method of fabricating a semiconductor **device** by the use of laser crystallization steps is provided. During these crystallization steps, an amorphous or polycrystalline semiconductor is crystallized by laser irradiation in such a way that generation of ridges is suppressed. Two separate laser crystallization steps are carried out. First, a laser irradiation step is performed in a vacuum, using somewhat weak laser light. Then, another laser irradiation step is performed in a vacuum, in the atmosphere, or in an oxygen ambient with intenser laser light. The first laser irradiation conducted in a vacuum does not result in satisfactory crystallization. However, this irradiation can suppress generation of ridges. The second laser irradiation step is performed in a vacuum, in the atmosphere, or in an oxygen ambient to achieve sufficient crystallization, but no ridges are produced.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2000:150081 USPATFULL
TI Method of processing semiconductor **device** with laser
IN Kousai, Takamasa, Ohsaka, Japan
Zhang, Hongyong, Kanagawa, Japan
Miyanaga, Akiharu, Kanagawa, Japan
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa, Japan (non-U.S. corporation)
Sharp Kabushiki Kaisha, Osaka, Japan (non-U.S. corporation)

PI US 6143661 20001107
AI US 1998-133330 19980813 (9)
RLI Division of Ser. No. US 1995-462361, filed on 5 Jun 1995, now patented, Pat. No. US 5795795
PRAI JP 1994-309826 19941118
DT Utility
FS Granted
EXNAM Primary Examiner: Hiteshew, Felisa
LREP Nixon Peabody LLP, Costellia, Jeffrey L.
CLMN Number of Claims: 40
ECL Exemplary Claim: 1
DRWN 16 Drawing Figure(s); 5 Drawing Page(s)
LN.CNT 765
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 15 OF 23 USPATFULL on STN
AB In an annealing process in which laser light is irradiated to a semiconductor thin film, a refractive index of the semiconductor thin film after laser light irradiation is measured and conditions for the next laser light irradiation are adjusted based on the measured refractive index value. For example, laser light irradiation conditions are adjusted so that semiconductor thin films always have the same refractive index. As a result, the annealing can be performed under the same conditions at every laser light irradiation even if the laser light irradiation conditions vary unavoidably. For a crystalline silicon film, if the refractive index is larger than 3.5, then a thin-film transistor using such as film has desired crystallinity and flatness properties such that a field-effect mobility is greater than 100 cm.sup.2 /Vsec.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2000:57169 USPATFULL
TI Optical processing method with control of the illumination energy of laser light
IN Yamaguchi, Naoaki, Kanagawa, Japan
Tanaka, Koichiro, Kanagawa, Japan
Teramoto, Satoshi, Kanagawa, Japan
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa, Japan (non-U.S. corporation)
PI US 6059873 20000509
AI US 1995-451648 19950526 (8)
PRAI JP 1994-139404 19940530
DT Utility
FS Granted
EXNAM Primary Examiner: Gulakowski, Randy; Assistant Examiner: Alanko, Anita
LREP Robinson, Eric J.Nixon Peabody LLP
CLMN Number of Claims: 29
ECL Exemplary Claim: 1
DRWN 14 Drawing Figure(s); 8 Drawing Page(s)
LN.CNT 758
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 16 OF 23 USPATFULL on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy density profile that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to satisfy a relationship L.sub.n ≥D.

AN 1998:119990 USPATFULL
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, Japan
Tanaka, Koichiro, Kanagawa, Japan
Kusumoto, Naoto, Kanagawa, Japan
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, Japan (non-U.S. corporation)

PI US 5815494 19980929
AI US 8000263 19970212 (8)
PRAI JP 8-050888 19960213
DT Utility
FS Granted
EXNAM Primary Examiner: Scott, Jr., Leon
LREP Fish & Richardson, P.C.
CLMN Number of Claims: 16
ECL Exemplary Claim: 1
DRWN 32 Drawing Figure(s); 16 Drawing Page(s)
LN.CNT 925

L9 ANSWER 17 OF 23 USPATFULL on STN
AB A method of fabricating a semiconductor **device** by the use of laser crystallization steps is provided. During these crystallization steps, an amorphous or polycrystalline semiconductor is crystallized by laser irradiation in such a way that generation of ridges is suppressed. Two separate laser crystallization steps are carried out. First, a laser irradiation step is performed in a vacuum, using somewhat weak laser light. Then, another laser irradiation step is performed in a vacuum, in the atmosphere, or in an oxygen ambient with intenser laser light. The first laser irradiation conducted in a vacuum does not result in satisfactory crystallization. However, this irradiation can suppress generation of ridges. The second laser irradiation step is performed in a vacuum, in the atmosphere, or in an oxygen ambient to achieve sufficient crystallization, but no ridges are produced.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 1998:98820 USPATFULL
TI Method of processing semiconductor **device** with laser
IN Kousai, Takamasa, Ohsaka, Japan
Zhang, Hongyong, Kanagawa, Japan
Miyanaga, Akiharu, Kanagawa, Japan
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa, Japan (non-U.S. corporation)
PI US 5795795 19980818
AI US 1995-462361 19950605 (8)
PRAI JP 1994-309826 19941118
DT Utility
FS Granted
EXNAM Primary Examiner: Garrett, Felisa
LREP Sixbey, Friedman, Leedom & Ferguson, Ferguson, Jr., Gerald J., Costellia, Jeffrey L.
CLMN Number of Claims: 19
ECL Exemplary Claim: 1
DRWN 16 Drawing Figure(s); 5 Drawing Page(s)
LN.CNT 643
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 18 OF 23 USPATFULL on STN
AB A low temperature process for dehydrogenating amorphous silicon using lasers. Dehydrogenation occurs by irradiating one or more areas of a hydrogenated amorphous silicon layer with laser beam pulses at a relatively low energy density. After the multiple laser pulse irradiation at a relatively low energy density, the laser energy density is increased and multiple irradiation at a higher energy density is performed. If after the multiple irradiation at the higher energy density the amorphous silicon hydrogen content is still too high, dehydrogenation proceeds by multiple irradiations at a yet higher energy density. The irradiation at the various energy densities can result in the formation of polysilicon due to melting of the amorphous silicon layer. As irradiation may be selectively applied to the amorphous silicon, an integral amorphous silicon-polysilicon structure may be formed.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 94:102190 USPATFULL
TI Low temperature process for laser dehydrogenation and

crystallization of **amorphous silicon**
IN Mei, Ping, Palo Alto, CA, United States
Boyce, James B., Los Altos, CA, United States
Johnson, Richard I., Menlo Park, CA, United States
Hack, Michael G., Mountain View, CA, United States
Lujan, Rene A., Sunnyvale, CA, United States
PA Xerox Corporation, Stamford, CT, United States (U.S. corporation)
PI US 5366926 19941122
AI US 1993-73022 19930607 (8)
DT Utility
FS Granted
EXNAM Primary Examiner: Thomas, Tom; Assistant Examiner: Nguyen, Tuan
LREP Kelly, John M.
CLMN Number of Claims: 9
ECL Exemplary Claim: 1
DRWN 5 Drawing Figure(s); 5 Drawing Page(s)
LN.CNT 316
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 19 OF 23 USPATFULL on STN
AB Scanning laser **crystallization** of p- and n- type hydrogenated **amorphous silicon** alloy cladding layers enhances the doping efficiency of such layers without changing the luminescence or other important properties of the middle i-layer in a p-i-n **device**. The dc dark conductivity of the doped layers increases by a factor of about 100 to about 10,000 above a sharp laser energy density threshold whose magnitude increases with decreasing impurity concentration. In one method, a doped amorphous silicon alloy layer is deposited on an amorphous glass substrate, scanned with laser irradiation, and then an intermediate i-layer is formed over this layer. Another doped amorphous silicon alloy layer is deposited on this layer, doped oppositely from the first doped layer. The second doped layer is then crystallized by scanning laser irradiation, leaving the underlying i-layer virtually unchanged in optical and electronic properties.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 93:38397 USPATFULL
TI Laser **crystallized** cladding layers for improved **amorphous silicon** light-emitting diodes and radiation sensors
IN Winer, Kris A., Livermore, CA, United States
Thornton, Robert L., East Palo Alto, CA, United States
PA Xerox Corporation, Stamford, CT, United States (U.S. corporation)
PI US 5210766 19930511
AI US 1992-866737 19920410 (7)
RLI Division of Ser. No. US 1990-634896, filed on 27 Dec 1990, now patented, Pat. No. US 5162239
DT Utility
FS Granted
EXNAM Primary Examiner: Epps, Georgia Y.
LREP Townsend and Townsend Khourie and Crew
CLMN Number of Claims: 8
ECL Exemplary Claim: 1
DRWN 10 Drawing Figure(s); 5 Drawing Page(s)
LN.CNT 708
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 20 OF 23 USPATFULL on STN
AB Scanning laser **crystallization** of p- and n-type hydrogenated **amorphous silicon** alloy cladding layers enhances the doping efficiency of such layers without changing the luminescence or other important properties of the middle i-layer in a p-i-n **device**. The dc dark conductivity of the doped layers increases by a factor of about 100 to about 10,000 above a sharp laser energy density threshold whose magnitude increases with decreasing impurity concentration. In one method, a doped amorphous silicon alloy layer is deposited on an amorphous glass substrate, scanned with laser irradiation, and then an intermediate i-layer is formed over this layer.

Another doped amorphous silicon alloy layer is deposited on this layer, doped oppositely from the first doped layer. The second doped layer is then crystallized by scanning laser irradiation, leaving the underlying i-layer virtually unchanged in optical and electronic properties.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 92:96951 USPATFULL
TI Laser **crystallized** cladding layers for improved **amorphous silicon** light-emitting diodes and radiation sensors
IN Winer, Kris A., Livermore, CA, United States
Thornton, Robert L., East Palo Alto, CA, United States
PA Xerox Corporation, Stamford, CT, United States (U.S. corporation)
PI US 5162239 19921110
AI US 1990-634896 19901227 (7)
DT Utility
FS Granted
EXNAM Primary Examiner: Hearn, Brian E.; Assistant Examiner: Picardat, Kevin
LREP Townsend and Townsend
CLMN Number of Claims: 33
ECL Exemplary Claim: 1
DRWN 10 Drawing Figure(s); 5 Drawing Page(s)
LN.CNT 843
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 21 OF 23 USPAT2 on STN
AB In an annealing process in which laser light is irradiated to a semiconductor thin film, a refractive index of the semiconductor thin film after laser light irradiation is measured and conditions for the next laser light irradiation are adjusted based on the measured refractive index value. For example, laser light irradiation conditions are adjusted so that semiconductor thin films always have the same refractive index. As a result, the annealing can be performed under the same conditions at every laser light irradiation even if the laser light irradiation conditions vary unavoidably.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:117928 USPAT2
TI Optical processing **apparatus** and optical processing method
IN Yamaguchi, Naoaki, Kanagawa, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Teramoto, Satoshi, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, JAPAN (non-U.S. corporation)
PI US 6716283 B2 20040406
AI US 2002-35441 20020104 (10)
RLI Division of Ser. No. US 2000-547716, filed on 11 Apr 2000, now patented, Pat. No. US 6336969 Division of Ser. No. US 1995-451648, filed on 26 May 1995, now patented, Pat. No. US 6059873
PRAI JP 1994-139404 19940530
DT Utility
FS GRANTED
EXNAM Primary Examiner: Alanko, Anita
LREP Robinson, Eric J., Robinson Intellectual Property Law Office, P.C.
CLMN Number of Claims: 18
ECL Exemplary Claim: 1
DRWN 14 Drawing Figure(s); 8 Drawing Page(s)
LN.CNT 748
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L9 ANSWER 22 OF 23 USPAT2 on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy density profile that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to

satisfy a relationship L.sub.n≥D.

AN 2002:85247 USPAT2
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Kusumoto, Naoto, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, JAPAN (non-U.S. corporation)
PI US 6558991 B2 20030506
AI US 2001-930758 20010815 (9)
RLI Continuation of Ser. No. US 1998-141763, filed on 27 Aug 1998 Division of Ser. No. US 1997-800026, filed on 12 Feb 1997, now patented, Pat. No. US 5815494, issued on 29 Sep 1998
PRAI JP 1996-50888 19960213
DT Utility
FS GRANTED
EXNAM Primary Examiner: Elms, Richard; Assistant Examiner: Luhrs, Michael K.
LREP Fish & Richardson P.C.
CLMN Number of Claims: 43
ECL Exemplary Claim: 22
DRWN 32 Drawing Figure(s); 16 Drawing Page(s)
LN.CNT 1003

L9 ANSWER 23 OF 23 USPAT2 on STN
AB A method of **crystallizing** an **amorphous silicon** layer includes the steps of generating an **excimer laser** beam having a **first energy density** and a **second energy density**, irradiating an amorphous silicon layer with at least one exposure of the excimer, wherein the **first energy density** melts the amorphous silicon layer to a first depth from a surface of the amorphous silicon layer equal to the **first** thickness and the **second energy density** melts the amorphous silicon layer to a second depth from the surface of the amorphous silicon layer less than the first thickness.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:71490 USPAT2
TI **Excimer laser crystallization** of **amorphous silicon** film
IN Chung, Se-Jin, Gyeongsangbuk-do, KOREA, REPUBLIC OF
PA LG.Philips LCD Co., Ltd., Seoul, KOREA, REPUBLIC OF (non-U.S. corporation)
PI US 6656270 B2 20031202
AI US 2001-965844 20011001 (9)
PRAI KR 2000-57832 20001002
DT Utility
FS GRANTED
EXNAM Primary Examiner: Hiteshew, Felisa
LREP Morgan Lewis & Bockius LLP
CLMN Number of Claims: 14
ECL Exemplary Claim: 1
DRWN 13 Drawing Figure(s); 6 Drawing Page(s)
LN.CNT 435
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

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(FILE 'HOME' ENTERED AT 11:48:50 ON 03 MAY 2005)

FILE 'HCAPLUS, INSPEC, JAPIO, USPATFULL, USPAT2' ENTERED AT 11:49:17 ON 03 MAY 2005
L1 54128 S (EXCIMER(W)LASER#)
L2 13940950 S (SYSTEM OR APPARATUS OR DEVICE OR MECHANISM OR MACHINE)
L3 8677 S (CRYSTALLIZ?)(8A)(AMORPHOUS(4A)SILICON OR AMORPHOUS(4A)SI)
L4 153964 S (GAUSSIAN OR GAUSSIAN(6A)ENERG?)

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L5         20237 S (DENSITY(4A)PROFILE#)
L6         32042 S (HOMOGENIZER#)
L7          1844 S (FIRST OR PRIMARY)(6A)(ENERGY(4A)DENSIT?)
L8          3355 S (SECOND?)(6A)(ENERGY(4A)DENSIT?)
L9            23 S L1 AND L2 AND L3 AND L4 AND L7 AND L8
L10            7 S L1 AND L2 AND L3 AND L4 AND L5 AND L6 AND L7 AND L8

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STN
HCAPLUS, INSPEC, JAPIO, USPATFULL
5/3/05

=> d l10 1-7 abs,bib

L10 ANSWER 1 OF 7 USPATFULL on STN
AB A method of **crystallizing** an **amorphous silicon** layer includes the steps of generating an **excimer laser** beam having a **first energy density** and a **second energy density**, irradiating an amorphous silicon layer with at least one exposure of the excimer, wherein the **first energy density** melts the amorphous silicon layer to a first depth from a surface of the amorphous silicon layer equal to the **first** thickness and the **second energy density** melts the amorphous silicon layer to a second depth from the surface of the amorphous silicon layer less than the first thickness.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2004:80069 USPATFULL
TI **Excimer laser crystallization** of **amorphous silicon** film
IN Chung, Se-Jin, Gyeongsangbuk-do, KOREA, REPUBLIC OF
PA LG. PHILIPS CO., LTD. (non-U.S. corporation)
PI US 2004060506 A1 20040401
AI US 2003-689030 A1 20031021 (10)
RLI Division of Ser. No. US 2001-965844, filed on 1 Oct 2001, GRANTED, Pat. No. US 6656270
PRAI KR 2000-57832 20001002
DT Utility
FS APPLICATION
LREP MORGAN LEWIS & BOCKIUS LLP, 1111 PENNSYLVANIA AVENUE NW, WASHINGTON, DC, 20004
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 6 Drawing Page(s)
LN.CNT 468
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L10 ANSWER 2 OF 7 USPATFULL on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy **density profile** that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to satisfy a relationship L.sub.n≥D.

AN 2002:85247 USPATFULL
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Kusumoto, Naoto, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd, a Japanese corporation (non-U.S. corporation)
PI US 2002045288 A1 20020418
US 6558991 B2 20030506
AI US 2001-930758 A1 20010815 (9)
RLI Continuation of Ser. No. US 1998-141763, filed on 27 Aug 1998, PENDING
Division of Ser. No. US 1997-800026, filed on 12 Feb 1997, PATENTED
PRAI JP 1996-50888 19960213
DT Utility
FS APPLICATION
LREP SCOTT C. HARRIS, Fish & Richardson P.C., Suite 500, 4350 La Jolla Village Drive, San Diego, CA, 92122
CLMN Number of Claims: 37
ECL Exemplary Claim: 1
DRWN 16 Drawing Page(s)
LN.CNT 992

L10 ANSWER 3 OF 7 USPATFULL on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy **density profile** that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to satisfy a relationship L sub.n≥D.

AN 2002:82439 USPATFULL
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Kusumoto, Naoto, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, JAPAN (non-U.S. corporation)
PI US 6373870 B1 20020416
AI US 1998-141763 19980827 (9)
RLI Division of Ser. No. US 1997-800026, filed on 12 Feb 1997, now patented, Pat. No. US 5815494
PRAI JP 1996-50888 19960213
DT Utility
FS GRANTED
EXNAM Primary Examiner: Scott, Jr., Leon
LREP Fish & Richardson P.C.
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 32 Drawing Figure(s); 16 Drawing Page(s)
LN.CNT 937

L10 ANSWER 4 OF 7 USPATFULL on STN
AB A method of **crystallizing** an **amorphous** **silicon** layer includes the steps of generating an **excimer laser** beam having a **first** **energy density** and a **second energy** **density**, irradiating an amorphous silicon layer with at least one exposure of the excimer, wherein the **first energy** **density** melts the amorphous silicon layer to a first depth from a surface of the amorphous silicon layer equal to the **first** thickness and the **second energy density** melts the amorphous silicon layer to a second depth from the surface of the amorphous silicon layer less than the first thickness.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:71490 USPATFULL
TI **Excimer laser crystallization** of **amorphous silicon** film
IN Chung, Se-Jin, Gyeongsangbuk-do, KOREA, REPUBLIC OF
PA LG.PHILIPS LCD CO., LTD. (non-U.S. corporation)
PI US 2002038626 A1 20020404
US 6656270 B2 20031202
AI US 2001-965844 A1 20011001 (9)
PRAI KR 2000-57832 20001002
DT Utility
FS APPLICATION
LREP MORGAN LEWIS & BOCKIUS LLP, 1111 PENNSYLVANIA AVENUE NW, WASHINGTON, DC, 20004
CLMN Number of Claims: 20
ECL Exemplary Claim: 1
DRWN 6 Drawing Page(s)
LN.CNT 468
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

L10 ANSWER 5 OF 7 USPATFULL on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear

on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy **density profile** that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to satisfy a relationship L.sub.n ≥D.

AN 1998:119990 USPATFULL
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, Japan
Tanaka, Koichiro, Kanagawa, Japan
Kusumoto, Naoto, Kanagawa, Japan
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, Japan (non-U.S. corporation)
PI US 5815494 19980929
AI US 8000263 19970212 (8)
PRAI JP 8-050888 19960213
DT Utility
FS Granted
EXNAM Primary Examiner: Scott, Jr., Leon
LREP Fish & Richardson, P.C.
CLMN Number of Claims: 16
ECL Exemplary Claim: 1
DRWN 32 Drawing Figure(s); 16 Drawing Page(s)
LN.CNT 925

L10 ANSWER 6 OF 7 USPAT2 on STN
AB Laser annealing is performed by irradiating, while scanning, a semiconductor thin-film with laser light. The laser light that is linear on the irradiation surface is moved in its line-width direction and applied non-continuously. The laser light has, in its line-width direction, an energy **density profile** that assumes a step-like form in which the energy density varies in a step-like manner. In particular, the scanning pitch D and the step widths L.sub.n are so set as to satisfy a relationship L.sub.n≥D.

AN 2002:85247 USPAT2
TI Laser irradiation **apparatus** and laser irradiation method
IN Yamazaki, Shunpei, Tokyo, JAPAN
Tanaka, Koichiro, Kanagawa, JAPAN
Kusumoto, Naoto, Kanagawa, JAPAN
PA Semiconductor Energy Laboratory Co., Ltd., Kanagawa-ken, JAPAN (non-U.S. corporation)
PI US 6558991 B2 20030506
AI US 2001-930758 20010815 (9)
RLI Continuation of Ser. No. US 1998-141763, filed on 27 Aug 1998 Division of Ser. No. US 1997-800026, filed on 12 Feb 1997, now patented, Pat. No. US 5815494, issued on 29 Sep 1998
PRAI JP 1996-50888 19960213
DT Utility
FS GRANTED
EXNAM Primary Examiner: Elms, Richard; Assistant Examiner: Luhrs, Michael K.
LREP Fish & Richardson P.C.
CLMN Number of Claims: 43
ECL Exemplary Claim: 22
DRWN 32 Drawing Figure(s); 16 Drawing Page(s)
LN.CNT 1003

L10 ANSWER 7 OF 7 USPAT2 on STN
AB A method of **crystallizing** an **amorphous silicon** layer includes the steps of generating an **excimer laser** beam having a **first energy density** and a **second energy density**, irradiating an amorphous silicon layer with at least one exposure of the excimer, wherein the **first energy density** melts the amorphous silicon layer to a first depth from a surface of the amorphous silicon layer equal to the **first** thickness and the **second energy density**

melts the amorphous silicon layer to a second depth from the surface of the amorphous silicon layer less than the first thickness.

CAS INDEXING IS AVAILABLE FOR THIS PATENT.
AN 2002:71490 USPAT2
TI **Excimer laser crystallization** of **amorphous silicon** film
IN Chung, Se-Jin, Gyeongsangbuk-do, KOREA, REPUBLIC OF
PA LG.Philips LCD Co., Ltd., Seoul, KOREA, REPUBLIC OF (non-U.S. corporation)
PI US 6656270 B2 20031202
AI US 2001-965844 20011001 (9)
PRAI KR 2000-57832 20001002
DT Utility
FS GRANTED
EXNAM Primary Examiner: Hiteshew, Felisa
LREP Morgan Lewis & Bockius LLP
CLMN Number of Claims: 14
ECL Exemplary Claim: 1
DRWN 13 Drawing Figure(s); 6 Drawing Page(s)
LN.CNT 435
CAS INDEXING IS AVAILABLE FOR THIS PATENT.

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(FILE 'HOME' ENTERED AT 11:48:50 ON 03 MAY 2005)

FILE 'HCAPLUS, INSPEC, JAPIO, USPATFULL, USPAT2' ENTERED AT 11:49:17 ON 03 MAY 2005

L1 54128 S (EXCIMER(W)LASER#)
L2 13940950 S (SYSTEM OR APPARATUS OR DEVICE OR MECHANISM OR MACHINE)
L3 8677 S (CRYSTALLIZ?)(8A)(AMORPHOUS(4A)SILICON OR AMORPHOUS(4A)SI)
L4 153964 S (GAUSSIAN OR GAUSSIAN(6A)ENERG?)
L5 20237 S (DENSITY(4A)PROFILE#)
L6 32042 S (HOMOGENIZER#)
L7 1844 S (FIRST OR PRIMARY)(6A)(ENERGY(4A)DENSIT?)
L8 3355 S (SECOND?)(6A)(ENERGY(4A)DENSIT?)
L9 23 S L1 AND L2 AND L3 AND L4 AND L7 AND L8
L10 7 S L1 AND L2 AND L3 AND L4 AND L5 AND L6 AND L7 AND L8

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